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AN EVALUATION OF SEEDLING MORTALITY ASSOCIATED WITH DAZOMET FUMIGANT AT HUMBOLDT NURSERY

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ABSTRACT

Mortality of seedlings transplanted to two locations at Humboldt Nursery was evaluated for possible cause or contributing factors. No pathogens were associated with the observed damaged or dead seedlings. Observations and laboratory analyzes suggest that toxicity of dazomet fumigant that had not dissipated from treated soil was the primary cause. Seedling stress resulting from poor shipping or storage conditions may have contributed to the problem at one location.

INTRODUCTION

On February 22, 1988, Susan Frankel, Forest Pest Management Plant Pathologist, met with Humboldt Nursery Manager Cindy Henchell, and representatives of the Diamond Lake District, Umpqua National Forest. The objective of the visit was to evaluate the condition of plug stock from Dean Creek Nursery transplanted to dazomet (Basamid®)-treated soil in B Block, and to examine seedlings transplanted to treated soil in E Block. This report describes the problem, summarizes lab analyzes performed on samples collected, and presents management recommendations for reducing similar losses in the future.

PROBLEM HISTORY

B Block

One objective of the trip was to observe a problem of uncertain cause affecting Plug-1 Shasta red fir, white fir, and Douglas-fir. Seedlings had been grown at Dean Creek Nursery, Reedsport, Oregon and shipped to Diamond Lake Ranger District, Umpqua National Forest. The stock was stored at the District for a few weeks and then shipped to Humboldt Nursery, November 13, 1987. The stock was immediately prepared for storage by removing tubes and soil mix, and pruning the root system to six inches. At that time, nursery personnel noticed dead terminals on a small percentage of Shasta red fir seedlings. These were packed separately. Nursery personnel reported that the rest of the stock appeared healthy, with no evidence of disease on tops or roots.

The eastern two-thirds of the block were fumigated on November 6, 1987 with dazomet at 350 lbs. per acre. It was incorporated to an estimated depth of 10 inches. Rainfall from the time of fumigation through December 31, 1987 totaled 18.74 inches.

Four weeks after fumigation soil samples were collected according to instructions from Bruce Kelpsas (Northwest Chemical Company, Basamid Technical Consultant) from random locations in the fumigated area to a depth of 36 inches. The cores were placed immediately in plastic bags and kept sealed until transferred to large petri dishes. Radish seeds were planted in these samples to determine if the fumigant had fully dissipated. The radish radicals became burned after approximately three days indicating the dazomet was still present. The test was repeated approximately four weeks later (beginning of January). There was no indication of residual dazomet among this second sampling.

The stock was planted into the east end of B Block beginning with the Shasta red fir on January 26, 1988. The white fir and the first two Douglas-fir seedlots (202-15016-530-85-SB an 202-15-493-03000-85-SIA) were planted the following day. The planting crew noticed some dead tops associated with black cankers in the Douglas-fir as they were being planted. They also commented that the foliage of some of the stock felt slimy. Samples were sent to FPM for evaluation (FPM Detection Report No. 580). Botrytis was isolated from these seedlings, but was thought to be secondary. Planting was discontinued on January 28, 1988 due to rain.

The last three Douglas-fir seedlots were planted on February 9 and 10. At that time, the Douglas-fir previously planted appeared to be fading. Early estimates were that 80% of the Douglas-fir was affected. Samples were sent to FPM (Detection report No. 579). No pathogens were found associated with roots or shoots of seedlings.

The field into which the seedlings were planted (B Block) had shown no unusual mortality problems in previous crops. This area was most recently used as an outplanting site for fertilizer test stock (2-0 bareroot grown at Humboldt Nursery). It was planted in the Spring of 1984, grown for three growing seasons and removed in 1987. The trees were healthy at time of removal.

E Block

A portion of E Block was fumigated with 350 lbs./acre dazomet in September, 1987. Douglas-fir (1-0) grown at Humboldt Nursery were transplanted to the treated soil and to adjacent soil treated with methyl bromide in October. Dessication of the stock planted in dazomet-treated soil, but not methyl bromide-treated soil, was reported in December. Observations on seedling condition are presented below.

LABORATORY EVALUATIONS

The following section summarizes results of laboratory evaluations done on seedling and soil samples collected February 22, 1988. Seedlings were examined and root and stem pieces plated on to selective medias.

1. **Species:** Douglas-fir.
   Origin of stock: Dean Creek Nursery.
   Location: East side of B Block, treated with dazomet November, 1987.
   Symptoms: Seedlings showed a range of symptoms as follows: dead tops, dead main stem of roots with distinct live/dead margin, bluish roots, lack of feeder roots, small necrotic areas on main root and laterals, twisted needles, dessication, and necrotic strips on needles.
   Lab Results: Fusarium was isolated from all root pieces plated onto Fusarium selective media. No Pythium or Phytophthora was seen. No other pathogens were isolated or observed on stems, needles or roots.
   Conclusions and Comments: The Fusarium is not believed to be the causal agent of observed symptoms. The problem is widespread throughout the planting area and appeared approximately 10 days after planting. The pattern of disease development and lab results indicate that the problem is not due to a pathogen. Problem could be due to chemical injury. It is hypothesized that the dazomet granular fumigant was washed down into the soil profile by the 18 inches of rain that fell between the application date and planting. The first warm temperatures of the season activated the dazomet, releasing toxic vapors that damaged the recently planted transplants. It is not known exactly why the residual dazomet in the soil was not detected through use of a radish seed germination test.

   The report by nursery personnel of "slimy tops" and some poor quality seedlings at time of planting, indicates that seedlings may have been weak due to poor transit or storage conditions. This may have contributed to the problem as well.

2. **Species:** Shasta red fir.
   Origin of Stock: Dean Creek Nursery.
   Location: Eastside of B block.
   Symptoms: Similar to symptoms described above for Douglas-fir but, in general, damage is less severe and root systems appear healthier.
   Lab Results: Fusarium was isolated from all root pieces plated onto Fusarium selective media. Pythium levels were also high with Pythium growing out of 85% of root pieces placed on Pythium selective media. No Phytophthora was recovered.

Conclusions and Comments: Fusarium or Pythium are not responsible for damage. Comments made about Douglas-fir above apply (see above).

3. **Species:** Douglas-fir.
   Location: Block E; area treated with dazomet, September, 1987.
   Symptoms: Dead and dying seedlings that have dead main roots with distinct live/dead margin, necrotic spots on roots, lack of feeder roots. Many seedlings are dead and dessicated. Similar symptoms were not observed in the adjacent area treated with methyl bromide.
   Lab results: No Fusarium, Pythium, Phytophthora or other pathogen was recovered.

   Conclusions and Comments: This problem was observed last fall. At that time, the damage was thought to be physiological or environmental. Dazomet was applied to this ground according to label directions, under the supervision of the chemical company representative. Dissipation of vapors was tested for prior to planting and no reason for concern was found. It is thought that a significant portion of the damage observed is due to dazomet phytotoxicity.

Soil samples were also collected from the two affected areas. The results of the soil analysis are reported below:

1. Soil from Block E, dazomet-treated area.
   Germination test: Seeds germinated after two days.
   Fusarium count = 60 propagules per gram (ppg); count is low.
   Pythium was recovered on pear bait, but no Phytophthora was seen.

2. Soil from B Block adjacent to where Dean Creek seedlings are planted (Sec. 5-6). Ground is currently fallow.
   Germination test: Seeds germinated after 2 days.
   Fusarium count = 0 ppg
   Pythium was recovered on pear bait; no Phytophthora was seen.

3. Soil from area planted with Dean Creek seedlings, Block B, Sec 1-2.
   Germination test: Seeds germinated after 2 days.
   Fusarium count = 10 ppg
   No Pythium or Phytophthora were recovered.

PLANTING STOCK EVALUATION

On March 3, 1988, The Diamond Lake District shipped plug seedlings, grown at Dean Creek Nursery and received at the District for outplanting, to FPM for evaluation of seedling quality and health. These seedlings were part of the same order as the seedlings planted in Block B at Humboldt Nursery. Samples were also sent to Peninsu-lab, Kingston, Washington, for disease evaluation. No significant pathogens were recovered from these seedlings, indicating that nursery stock shipped from Dean Creek was pathogen-free. It does not guarantee that stock shipped last November was healthy or did not become damaged in storage or transit to Humboldt Nursery.

CONCLUSIONS

Upon reviewing the problem history, lab analyses and field observations, the exact cause of seedling mortality was not pinpointed. It is thought to be in part due to phytotoxicity of dazomet fumigant that had not dissipated prior to planting of transplants. Poor quality of Dean Creek stock at time of planting may also have contributed to the problem in B Block. Seedlings examined appeared weakened due to poor storage or transit conditions.

RECOMMENDATIONS

1. If possible, apply dazomet earlier in late summer or early fall, while soil temperatures are still high. This will help insure that granular dazomet will break down and dissipate from soil prior to planting. The fumigant is ineffective at soil temperatures below 43 F. The recommended waiting period between treatment and replanting decreases as soil temperature increases. If time interval between application and planting is greater than 4 months, soil samples should be taken prior to planting and analyzed for the build up of soil fungi.

2. Apply dazomet exactly as directed on label.

3. Use tightly sealed jars, rather than petri dishes, for radish germination test. Vessel must be air tight.

4. Root prune transplants just prior to planting, instead of pruning them upon receipt at nursery and then placing them in storage.